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Journal of the Society of Arts.

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FRIDAY, OCTOBER 25, 1867.

Proceedings of Institutions.

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Avenham (Preston) Institution for the Diffusion of Knowledge.—The thirty-ninth annual report, presented on the 1st inst., records that the year has been, on the whole, one of satisfactory progress for the Institution. The number of members has undergone an increase of more than ten per cent. In the income from subscriptions the increase is still more considerable, being fifteen per cent. The constantly growing requirements of readers in the library, reading room, and news room, have been liberally met. In the evening classes some extension has been made in the range of instruction afforded, the attendance of pupils has been larger than in previous years, and the results of the several examinations held during the year have been most encouraging. The chess and conversation room, opened in the early part of the year, promises to be very popular. The number of members on the register is 507; the number last year was 456. The library now contains 8,116 vols., of which 276 have been added during the year. Classes in the following subjects were in operation during the class session:—Fine art, freehand, model, machine and mechanical drawing, geometry, and perspective (School of Art); inorganic chemistry, animal physiology, geology, and the principles of mechanics' (science classes); mathematics, English history, the French language, phonography, and the usual elementary subjects. The number on the class register is 312. Examinations have been held by the Society of Arts, by the Science and Art Department, by the Union of Lancashire and Cheshire Institutes, and by the council of the Institution. The School of Art has now been in existence seven years, and has, subject to occasional fluctuations, continued to make progress. With reference to the science classes, although the number of students on the register during the session was large, and the attendance was good, only seven candidates presented themselves at the examination, in May last. The Examinations of the Society of Arts, and the local examinations held by the council of this Institution, have been adopted this year for the first time. The results of the Examination of the Society of Arts are very satisfactory. The local examinations are instituted by the council with the view of affording the stimulus of recognition and reward to the efforts of class students whose cases might appear not to be sufficiently met by the provisions of the other examinations. A special feature of the local examinations was formed by the "English Composition Prizes" offered by the President of the Institution. These prizes were offered for English essays, the subjects being—For males:—1, "The Influence of Education on Life, Character, and Manners;" 2, "On Economy in the Expenditure of Money;" 3, "On the Choice of Books, and the Art of Reading Them;" 4, "On the Qualities which Conduce to Success in Life;" 5, "On the Advantage and the Means of Public Recreation;" 6, "A Description of the Avenham Parks." For females:—1, "On the Advantages of Education;" 2, "On Home Comfort;" 3, "On Household Economy;" 4, "On Good Manners and Obliging Behaviour;" 5, "On Dress;" 6, "On the Means of Recreation Consistent with the Discharge of the Duties of Domestic Life." For the prizes offered to males not more than three competitors appeared; for the prizes offered to females there appeared no competitors. The treasurer's accounts show that the current expenditure has been met by the income, which was £546 11s. 10d. The penny bank account shows a balance of £35 14s., representing deposits still remaining unclaimed. While, in conclusion, the Council refer with satisfaction to the steady progress of the Institution, indicated in the present report, and while they fully recognise the value of the results already accomplished by the Institution, the Council cannot but feel how inadequate are these results when viewed with reference to the number and educational needs of the class to which the Institution more particularly addresses itself,—the artizan class. So far as the agency of this Institution is concerned, these educational needs must remain inadequately provided for, until the pecuniary resources of the Institution are considerably augmented. A large addition to the machinery of the evening classes is urgently called for, and this, with the limited pecuniary means and building accommodation at their command, the Council are not in a position to afford. Class instruction is now everywhere recognised as the chief agency by means of which the objects contemplated by the promoters of Mechanics' Institutions are to be accomplished. In large towns like Preston, however, the full benefits to be derived from this agency will never be obtained so long as the instruction given is confined to one central Institution. Some well devised scheme of district evening classes is, therefore, greatly to be desired. It is believed that no insurmountable difficulty would be found to the establishment of such classes, while their value in diffusing the benefits of education amongst the working population will be apparent to all.

Chorley Mechanics' Institution.—The report for the year ending August 20th, 1867 (being the eleventh), states that the institution is now out of debt, with a balance of £7 5s. 4d., the year's receipts having been £105 2s. 8d. The number of members for the past year has been, honorary 34, news room 88, and ordinary 79, and the average attendance at the evening classes has been 35. The third examination of these classes, in connection with the Lancashire and Cheshire Union of Institutes, was held in February last, when out of the ten candidates examined, nine obtained certificates. The news room has been supplied during the past year with several new periodicals, and has been attended by a large number of readers. The library and smoking room also continue to be extensively patronised. There have been five penny readings and one concert during the season, which have realised a profit of £3 8s. 11d.

CARBOLIC OR PHENIC ACID AND ITS PROPERTIES.

The following lecture was delivered in French, a few months since, by Dr. Crace Calvert, F.R.S., &c., before the Society for the Encouragement of National Industry in France:—

Gentlemen,—I have readily accepted the friendly invitation of your illustrious president, Mr. Dumas, to submit to your notice some facts relative to carbolic acid. But before doing so, allow me to express publicly the feelings of gratitude which I owe to France for having opened to me the way to the profession which I pursue with such pleasure. In truth, it is to the sympathy of scientific men of this country, to the friendly assistance of one of your scientific celebrities, M. Chevreul, and to the liberality of your institutions, that I owe the knowledge I have acquired, the elements of which I gained at the Gobelins and at the Museum of Natural History during the stay I made there. After these remarks I will proceed with the subject of my lecture.

No doubt most persons present are aware that when coals are submitted to the action of a dull red heat, in a retort, products are obtained which may be grouped into four classes.

1st. Gaseous products, commonly called coal gas, and which are now employed in so general a manner as means of illumination, sources of heat and motive power.

2nd. Water containing ammonia and ammoniacal salts, substances which chemistry purifies, modifies, and which are then utilised in agriculture, manufactures, and medicine.

3rd. There distils with the above products a black, sticky substance, of an unpleasant odour, called tar.

4th. There remains in the retort a solid, porous body, which is known to us all as coke.

When the above-mentioned product called tar is submitted to distillation, water first comes over, then there distil jointly with this fluid, liquid carburretted hydrogens, which being lighter, float on it, and are therefore called light oils of tar: and, lastly, compounds heavier than water are collected, which bear the name of heavy oils.

It is these heavy oils which were the first tar products utilised in manufacture. Their consumption made such rapid progress in England, that special manufactories were established for their preparation, and these works were, for a long period, the only ones in which tar products were produced. Most of them were established towards 1837, for the production chiefly of coal naptha, used for many purposes, and heavy oils, employed for the preservation of railway sleepers, by a process discovered by Mr. John Bethell, by means of which they are preserved twelve, fifteen, or even twenty years; whilst without it they decay after three or four years. I have much pleasure in calling your attention to a very remarkable and very complete work upon the creosoting of wood, by M. Forestier, chief engineer of the department of La Vendée, assisted by M. Marin, an engineer. These gentlemen have made, as you can see, numerous experiments, the result of which is that wood thus treated is preserved from decay in water as well as under ground, and, what is very important, it is no longer destroyed by that very destructive insect the *teredo*.

Lastly, there remains in the still (after the heavy oils and semi-solid substances have distilled off) a product, which is fluid at the high temperature at which this operation is conducted, but which, when exposed to the natural temperature of the atmosphere, becomes hard and brittle, and is known under the name of pitch, and which is so largely employed in Paris under the name of asphalte, bitumen, &c., to form the foot pavements and public walks, as well as for the manufacture of a sort of concrete, called in England patent fuel.

I now come to carbolic acid.

It is twenty years since Laurent, the eminent chemist, first pointed out the easy method of extracting carbolic acid from coal tar. It consisted in submitting the light oils to a fractional distillation, and then treating with a concentrated solution of potash those products which distilled at a temperature between 160 and 200 degrees, separating the alkaline solution from the hydrocarbons which floated on it, and then neutralising by an acid which liberated the carbolic acid.

Such was Laurent's method of preparing carbolic or phenic acid, but pure carbolic acid was only there in a very small proportion; it was, in fact, a mixture composed chiefly of different liquids similar in properties and composition to carbolic acid, and though Laurent succeeded in obtaining pure carbolic acid, still the process devised by him was too expensive to answer as a commercial production; and besides, his method of operating was too complicated.

In 1847, Mansfield, and towards 1856, M. Bobœuf, made known processes which, in fact, were only a modification of Laurent's, for they consisted principally in employing caustic soda instead of potash, and in treating the whole of the light oils instead of a special portion, as Laurent had done; but by these processes a very impure acid was still obtained, from which it was very difficult, as experience has shown us, to extract pure carbolic acid; however, in a commercial point of view, the process of these gentlemen was a step in advance. I may add that it was this impure carbolic acid which Mr. John Bethell manufactured, at my request, about the year 1847; and it was this impure acid which was also employed by several chemists who, like myself, studied the properties of this substance, and who endeavoured to apply it usefully, either in the production of picric acid, or in preventing the transformation of tannic acid into gallic acid, in tanning substances, or, finally, in the preservation of subjects for the dissecting-room. M. Bobœuf also made use of it in preserving organic bodies from putrefaction, a property which has received of late very important applications.

In 1859, M. Marnas, of the firm of Guinon, Marnas, and Bonnet, of Lyons, came to Manchester, and asked me to furnish him with a purer carbolic acid than had been as yet manufactured. He showed me a white and crystalline product, which he gave as a specimen. It was then necessary to make new experiments, and I discovered that the best mode of preparation was not by treating light or heavy oils of tar with concentrated alkalies, but, on the contrary, treating the impure benzines of commerce or napthas with weak alkaline solutions. By this means a semi-fluid, blackish product was obtained, a little heavier than water, of a density of 1·06, and which contained 50 per cent. of real carbolic acid, which acid I managed to separate in part by careful distillation. It is this product which was employed by Messrs. Guinon, Marnas, and Bonnet, and others, till 1861, for the manufacture of colours derived from carbolic acid. At this period the colours obtained from aniline were so fine and brilliant that, to keep up a comparison with them, it was necessary to improve those derived from carbolic acid. To effect this it was necessary to improve the quality of the carbolic acid then manufactured, and, after some trials, we (F. C. Calvert and Co.) produced carbolic acid in white detached crystals, melting at between 26 and 27 degrees, and I may here add that this is the product which is now generally employed in commerce and industry, for there are numerous examples of it at the present Universal Exhibition. In 1863 this relative purity was not sufficient. The same firm which had requested the improvements which I have before named asked us to try and make it still purer. We again set to work, and produced commercially Laurent's carbolic acid; that is to say, a substance melting at 34 degrees centigrade, and boiling exactly at 186 degrees. This became a very important commercial product for us, and we delivered large quantities monthly.

From this time I made many efforts to draw the attention of medical men to the really remarkable therapeutic properties of carbolic acid, but the tarry and sulphurous smell which it still possessed was a serious obstacle to its application. I soon succeeded in overcoming this difficulty, and towards the end of the year 1864 our firm was in a position to deliver in considerable quantities carbolic acid deprived of sulphurous compounds, and therefore fit for all medicinal uses. But I am glad to say that the series of improvements in the manufacture of pure carbolic acid did not stop there, for towards the end of last year I discovered a process which now enables me to show you a product completely deprived of all disagreeable odour and tarry flavour, and, in fact, as pure, though extracted from tar, as if it had been produced artificially by the help of the reactions recently discovered by Messrs. Wurtz and Kékulé, based upon the direct transformation of benzine into carbolic acid, or by the well-known changes by which it may be obtained from salicylic acid or nitro benzoic. This carbolic acid is distinguished from Laurent's in being soluble in 20 parts of water, whereas the latter requires 33. It is fusible at 41, instead of 34, and boils at 182 degrees, instead of 186, but it gives, like Laurent's, the blue colour described by M. Berthelot when mixed with ammonia, and to the solution is added a small quantity of a hypochlorite; the same effect is also produced when you expose to the vapours of hydrochloric acid a chip of deal soaked in this pure carbolic acid.

It was supposed that, as Laurent's acid had a constant boiling and crystallisation point, it was a pure and definite substance. Now, the production of our new acid shows it is nothing of the kind, the product of Laurent being only a mixture of our pure carbolic acid and a liquid homologue; for when to the acid of Laurent is added a certain proportion of water, and the mixture is exposed to a temperature of four degrees centigrade, it deposits a crystalline substance in large octahedrons; this substance is a hydrate of carbolic or phenic alcohol, that is to say, carbolic acid combined with an equivalent of water of crystallisation. This fact is important in a chemico-theoretical point of view, for it exhibits the only example known of an alcohol which, combining with water, forms a crystallised and solid hydrate. By removing from this hydrate the equivalent of water which it contains, carbolic acid is obtained in its purest state.

We will now rapidly glance at the applications which have been made of this product for sanitary purposes, in medicine, agriculture, and manufactures.

The disinfectant or rather antiseptic properties of carbolic acid are very remarkable. The beautiful researches and discoveries of M. Pasteur have shown that all fermentation and putrefaction is due to the presence of microscopical vegetables or animals, which, during their vitality, decompose or change the organic substances, so as to produce the effects which we witness, and carbolic acid exercises a most powerful destructive action upon these miscroscopic and primitive sources of life. Carbolic acid, therefore, is an antiseptic and disinfectant much more active and much more rational than those generally in use.

And allow me further to add that disinfectants, such as chlorine, permanganate of potash, or Condy-fluid, operate by oxidising not only the gaseous products given off by putrefaction, but all organic matters with which they may come in contact; whilst carbolic acid, on the contrary, merely destroys the causes of putrefaction, without acting on the organic substances. The great difference which therefore distinguishes them, is, that the former deals with the effects, the latter with the causes. Again, these small microscopic beings, these ferments, are always in small quantities as compared to the substances on which they act, consequently a very small quantity of carbolic acid is necessary to prevent the decomposition of substances; therefore, its employment is both efficacious and economical. Moreover, carbolic acid is volatile; it meets with and destroys, as Dr. Jules Lemaire says, the germs or sporules which float in the atmosphere, and vitiate it, and this cannot be the case with Condy's fluid, chloride of zinc or iron, which act only by contact, and are mere deodorizers. This is why carbolic acid was used with such marked success, and therefore so largely, in England, Belgium, and Holland during the prevalence of cholera and of the cattle plague. The antiseptic properties of carbolic acid are so powerful that $\frac{1}{1000}$, even $\frac{1}{5000}$ will prevent the decomposition, fermentation, or putrefaction for months of urine, blood, glue solution, flour, paste, fœces, &c., &c.; in fact, its vapour alone is sufficient to preserve meat in confined spaces for weeks; a little vapour of this useful substance will preserve meat for several days in the ordinary atmosphere, and prevent it being fly-blown; lastly, $\frac{1}{10000}$ has been found sufficient to keep sewage sweet; and I am proud to say that the British Government have decided to use exclusively our carbolic acid (as a disinfectant), not only on board her Majesty's Navy, but in other Government departments. Although questions of public health are the province of medicine, still permit me to say a few words on the medicinal properties of carbolic acid. This question deserves to be treated thoroughly, for carbolic acid is susceptible of so many applications in this direction; its properties are so marked, so evident, and so remarkable, that they cannot be too much published, and it is rendering a service to mankind to make known the employment of so valuable a therapeutic agent.

I wish all who are listening to me were medical men, for I could show, by numerous and undeniable facts, the advantage they might derive from carbolic acid, and if my testimony was not sufficient to convince you, I would invoke the authority of men justly esteemed amongst you. I would recal to you the words of the good and learned Gratiolet and those of Dr. Lemaire, showing that carbolic acid is the most powerful acknowledged means of contending with contagious and pestilential diseases, such as cholera, typhus fever, small pox, &c. Maladies of this order are very numerous, but in carbolic acid we find one of the most powerful agents for their prevention. Besides its antiseptic action, the caustic properties of carbolic acid are found useful; most beneficial effects are obtained from it in the treatment of very dangerous and sometimes mortal complaints, such as carbuncle, quinsy, diptheria, &c., as shown by Dr. Turner, of Manchester, and also in less severe affections, such as hœmorrhoids, internal and external fistulas, and other similar complaints. But what must be especially mentioned is the employment of carbolic acid in preserving in a healthy state certain purulent sores, and preventing the repulsive smell which comes from them, a smell which is the symptom of a change in the tissues of the flesh, and which often presents the greatest danger to the patient. The services which carbolic acid renders to surgery can be judged of by reading several most interesting papers lately published in the *Lancet* by Mr. Lister, F.R.S., on compound fractures, ulcers, &c., &c., and by visiting the two sick wards of Dr. Maisonneuve, at the Hotel Dieu. Further, I must not overlook the valuable application made of it to gangrene in hospitals by the eminent Mr. Paget. Lastly, it has been used by many of the most eminent medical men with marked success in those scourges of humanity, phthisis and syphilis.

In agriculture our firm has stimulated the employment of the carbolic acid for the cure of certain diseases very common to sheep—scab, for example. The method of treatment customary in similar cases was very imperfect as well as dangerous, whilst with carbolic acid this malady is cured, and without danger to the animal, by dipping it for a minute, often only for some seconds, in water containing a small quantity of carbolic acid. For this purpose pure acid would be too expensive, and is not used, nor concentrated acid, which ignorant men who have the care of sheep would not know how to use, but by the help of soap an emulsion is made. After having shorn the sheep it is dipped in this mixture; a single immersion in a bath containing $\frac{1}{60}$ of it is sufficient to effect a cure. After scab, the foot-rot is one of the worst and most frequent complaints. Carbolic acid is also for that an efficacious remedy. For this a mixture is made of the acid and an adherent and greasy substance, capable of forming a plaster, which can be made to adhere to the animal's foot for two or three days, preventing the contact of the air, allowing time for the application to produce its effect. But if the flock be numerous, it would take a long time to dress the four feet of each animal one after another; so, to make it more easy, a shallow tray is made of stone, a sort of trough; this is filled with the medicated mixture, and the sheep are made to pass through it; their feet are thus impregnated with the required substance. Permit me also to state that cattle cease to be annoyed with flies, &c., if washed with this solution, or a weak solution of carbolic acid.

Manufacturers have not yet availed themselves one tithe of the valuable properties of carbolic acid, and in this direction a new field is open to its use; still I may cite a few instances. The preservation of wood has been already referred to, and, thanks to its use, the great trade in skins and bones from Australia, Monte Video, Buenos Ayres, &c., is benefited. Wild animals living there in herds are slaughtered by thousands. Formerly they came to us in a bad state, half putrid, emitting an insupportable odour, and only fit for manure; in this state their price was not more than 150 francs the 1,000 kilogrammes, now, thanks to carbolic acid treatment, they arrive perfectly preserved; they can be employed for all the uses to which green or raw bones are usually applied, and the value of bones is raised as much as from 250 to 300 francs. Hides also arrive putrid, unless they have been dried rapidly in the sun or salted, which necessitated a long and costly operation; whilst it is only necessary to immerse them for twenty-four hours in a solution of two per cent. of carbolic acid, and dry them in the air, to secure their preservation. It is probable that in a short time the blood, intestines, and other parts of these animals will be, by means of carbolic acid, converted into manure, and imported into this country. In England carbolic acid is used in the preservation of guts at the gut works, for keeping anatomical subjects, and the preservation of all animal matter. Carbolic acid is also utilised in preventing the decomposition of the preparations of gelatine and albumen, used in spinning, dyeing, and calico printing.

One of the most interesting chapters in the history of carbolic acid is certainly that which treats of the production of colouring materials; they alone enter into comparison with those derived from aniline, and often enter into successful rivalry with them. Amongst the colouring matters derived from carbolic acid, the most important is, without fear of contradiction, picric acid. The discovery of this acid dates back to a distant period; it was studied by Welter, and was called Welter's bitter.

My illustrious master, M. Chevreul, resumed in 1807 the study of the action of nitric acid on organic matters, and showed, in an admirable paper, that picric acid was often produced when organic matters were acted upon by nitric acid. M. Chevreul discovered in the products of the oxidation of organic substances through nitric acid two different bodies, which he called *amer au minima* and *amer au maxima*, the latter being picric acid. This acid was again examined by Laurent in 1841. This profound chemist showed that the true generator of picric acid was carbolic acid; that in the action of nitric acid on the latter it formed three nitrogenated compounds, mononitrophenic acid, binitrophenic acid, trinitrophenic acid, the latter being also picric acid.

These interesting results of Laurent would perhaps have remained for a long time without any commercial value if picric acid had not been applied to dyeing, in 1847, by M. Guinon, senior, of Lyons. Since then the use of this acid has been much extended, not only in producing magnificent yellows, but also, joined with indigo, in the production of ordinary greens, or of *vert Lamière* with Prussian blue, so that its consumption may be valued at from 80 to 100,000 kilogrammes annually; our firm alone produces more than 300 kilogrammes weekly; and when it is considered that 1 kilogramme of picric acid dyes to an intense shade 70 to 100 kilogrammes of silk, or 40 to 50 kilogrammes of wool, the enormous quantity of textile materials dyed by this single product may be appreciated.

The processes used for the preparation of picric acid are still those which Laurent indicated in 1841; but instead of using carbolic acid, loaded with the heavy oils of tar, as M. Guinon had done, I sought to diminish the quantity of nitric acid, employed in mere waste, on the heavy oils of tar, which were then mixed with carbolic acid, and I am glad to say that since 1852 I have used, in the manufacture of picric acid, carbolic acid containing only some of its liquid homologues. In 1856, M. Bobœuf took out a patent in France for making picric with carbolic acid. But picric acid was then at a high price, and it is only since our firm has obtained carbolic acid cheap that picric acid can be produced freed of all those resinous materials which prevent its purification and low price; in fact, owing to our pure carbolic acid, picric acid is now manufactured chemically pure; this product, which was sold some years since at 30 to 40 francs the kilogramme, is now sold at the rate of 10 francs. Further, I may add that to apply it in a quick and economical manner it is desirable to add to the dye bath a small proportion of sulphuric acid; this method of manipulation, which is not generally known, is very important, for it is only in this way that the textile materials can be readily dyed, and the baths exhausted.

I shall now have the pleasure of calling your attention to the production of two new colouring substances derived from picric acid:—

1st. Picramic acid was, in the first instance, obtained by Wölher; by making sulphate of iron act upon picric acid, and neutralising with caustic barytes, a deep brown salt was thus produced, from which he separated the barytes by the help of sulphuric acid, and by these reactions M. Wöhler obtained an acid to which he gave the name of nitro-hematic acid; but it is to M. Aimé Girard that we owe the practical process by means of which we are able to manufacture great quantities of picramic acid. This acid imparts to silk a beautiful series of brown tints, similar to those obtained from catechu.

2nd. Isopurpurate of ammonia. It is with much pleasure that I noticed, at the exhibition, in M. Casthelaz's case, a coloured material, known in the trade by the name of soluble garnet, which, I am informed, is used especially by M. Chalamel, of Puteaux; this substance is particularly remarkable, as it is isomeric with the *purpurate of ammonia or murexide*. Although the preparation of this colouring material was first pointed out by M. Carey, still it is really due to a previous discovery, by Hlasiwitz, who called attention to the reaction of cyanide of potassium upon picric acid, and to which chemical reaction we owe the knowledge of manufacturing the isopurpurate for industrial purposes.

Before taking leave of picric acid it may not be without interest that I should state a curious application which has been made of the explosive property of its salts. During these last few years the picrate of potassium has been employed in great quantities, by Mr. J. Whitworth, for charging the bombs for destroying the iron plating of ships. When the projectiles thus prepared strike the iron masses, the enormous propelling force with which they are expelled from the gun is instantaneously converted into heat, and to such an extent that the ball becomes red hot, the heat decomposes the picrate of potash, and a violent explosion ensues, owing to the enormous quantities of vapours and gases which are generated in an instant of time. Whilst the alkaline picrates are endowed with such formidable properties, they also possess properties which are useful for the alleviation of human misery. Picric acid is an efficacious remedy in intermittent fevers. Persons affected with such types of fever, upon whom quinine has lost all its beneficial effects by continuous usage of it—and this is the case with some of our soldiers who return from India—derive, I am glad to say, wonderful benefit from the use of picric acid and picrates, as Dr. Aspland has proved to be the case, at the military hospital at Dukinfield. The knowledge of this fact may be useful in districts in which exist poor populations, for it affords them a cheap febrifuge; and, moreover, picric acid is not dangerous, as arsenical preparations are, nor does it derange the stomach like quinine.

To return to the colours derived from carbolic acid, allow me to remind you that when, in 1834, Runge discovered that acid amongst the products of coal tar, he observed at the same time the existence of two colouring substances, to which he gave the name of rosolic acid and brunolic acid.

I will not detail here the processes by which Runge extracted these substances from the residue of coal tar by means of lime, nor the method adopted by Messrs. Smith, Dussart, and Jourdin for producing these substances by direct oxidation of phenic or carbolic acid, but will describe rapidly the process which we now use to manufacture rosolic acid, and which should not be attributed, as is generally believed, to M. Kolbe, as it is due to M. Jules Persoz, the son of the celebrated Professor of tinctorial chemistry in the Conservatoire des Arts-et-Metiers. His process consists in making oxalic acid act upon sulphophenic acid at a temperature of about 160 degrees, and the product which results from it has the bronze green appearance of cantharides. To render it suitable for employment in dyeing it is only necessary to wash it so as to separate from it all the sulphuric acid with which it is contaminated. It is then known under the name of yellow coralline or aurine. It was our firm who first, in 1863, discovered that rosolic acid thus prepared could be employed directly as a dye, and introduced it to dyers under the name of aurine. This substance gives to silk and albuminised cotton magnificent orange colours, like those of basic chromate of lead or of turmeric. In 1860 M. Persoz, junior, discovered also that if rosolic acid was heated under pressure with ammonia it gave rise to a red substance, which he called péonine. Messrs. Guinon, Marnas, and Bonnet perfected the manufacture of péonine, and gave it the name of red coralline. This colouring substance gives to silk and worsted a flame-coloured tint and very brilliant scarlets. This firm were also the first to produce and introduce, towards the end of 1860, a blue dye, derived from carbolic acid, or, more so, rosolic acid, which they called azuline. Azuline is obtained by heating for several hours, at the temperature of about 180 degrees, a mixture of rosolic acid and aniline. It is only necessary then to treat this product with sulphuric acid, and to wash it with benzine, to produce a beautiful blue colouring matter, which presents, when dry, a red mass with gold-coloured tints. Azuline, although discovered before the aniline blues, which have since become formidable rivals to it, is still, I may add, manufactured in competition with them.

To Messrs. Guinon, Marnas, and Bonnet is also due the first production of a green derived from coal tar products. It was manufactured in 1863, therefore some months before the appearance of an aniline green, known as vert d'Uzèbe, which, however, with the exception of the iodine greens, is the only one now employed in dyeing. Viridine was obtained by this firm from a mixture of aniline, benzoic, and rosolic acids.

Phenicienne, discovered in 1863, by M. Roth, is another colouring matter derived from phenic acid; it produces fast colours, from a deep garnet red to a golden buff. Phenicienne is produced by the action of nitrosulphuric upon carbolic acid. I will now, with your permission, gentlemen, leave for a few seconds the products derived from phenic acid, in order to place before you certain claims to some inventions not sufficiently recognised by writers on aniline colours.

In 1860, Messrs. Clift, Lowe, and I, took out a patent for the direct production on prints, of a green called emeraldine, and the deep blue called azurine, a blue which resembles indigo, and which really, when printed in a concentrated form, may be confounded with a black. And although I do not desire to deprive Messrs. Lightfoot, Carlos Kœchlin, and Lanth, of any of the merit which belongs to them for the production of the beautiful black which everyone must have admired in the Exhibition, still I may be permitted to remark that their process is based upon the oxydation of aniline by chlorate of potash, and is therefore based on our patent, previously secured to their discoverers. The difference between their process and ours consists in the addition of a salt of copper, which addition is so important that I have no hesitation in saying it has decided the success of a black which now stands unrivalled.

I cannot conclude this retrospective review without calling your attention to a fact which seems to have escaped my colleagues; it is that the majority of the beautiful colours obtained from aniline are due to the industrial application of a discovery made by your illustrious president, M. Dumas, more than thirty years since. The discovery I mean is the principle, so rich and fruitful, which he named the law of substitutions; a law which has thrown so bright a light on modern chemistry, and which has prepared the way for such brilliant achievements, and which, I say, has also been the foundation of the production of the beautiful colouring substances which we all so much admire. Thus, in order to obtain aniline blues, violets, and greens, produced by the methods devised by the illustrious chemist, Dr. Hofmann, we substitute for a certain proportion of the hydrogen of rosaniline, an equivalent quantity of the alcoholic radicals, called phenyl, ethyl, methyl, and amyl. Further, this celebrated chemist has also shown that the blue obtained by Messrs. Girard and Delaire are also due to the same laws.

I am far, I regret to say, gentlemen, from having named all the remarkable properties and applications of carbolic or phenic acid; but I trust I have succeeded in making you share my enthusiasm for this valuable agent, which, after having rendered important services to most of the world's industries, still offers to chemists and to manufacturers a wide field for new applications.*

EXPERIMENTS WITH NITROGLYCERINE.

BY C. A. RICHTER, OF FREIBERG.†

The following is an account of the results of a comparison of the effects of nitroglycerine and the nitrate of soda gunpowder, which is used in this neighbourhood.

The first experiment was made under the guidance of one of the inventor's agents in the year 1865.

Beihilf shaft, which was being sunk 30ft. long by 8ft.

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* Dr. Calvert has supplied the Editor with the following additional remarks, explanatory of the distinctions between *deodorizers*, *disinfectants*, and *antiseptics*:—

We beg to offer the following remarks in reference to the peculiar advantages which carbolic acid possesses as an antiseptic, disinfectant, and deodorizer, as compared with substances which act only as disinfectants—such as bleaching powder and sulphurous acid, or with those substances which are deodorizers—as chloride of manganese, green copperas, nitrate of lead, &c.

Deodorizers.—All substances merely acting as such are neither disinfectants nor antiseptics, as they simply remove the noxious gases emitted from organic matters whilst in a state of decay or putrefaction, and as they do not possess the property of arresting decomposition or fermentation, it is no proof that the source of infection has been destroyed, for noxious smells and offensive gases are not themselves the real source of contagion, but merely indicators of its existence—the real source of disease and contagion being due, as proved by the latest investigations in science, to microscopic spores floating in the atmosphere, and which by their ulterior development and propagation, are believed to be the true source of contagion.

Disinfectants. - Under this head may be classed bleaching powder or chloride of lime, sulphurous acid and permanganate of potash: they first act as deodorizers, and then as disinfectants, because if employed in large quantities they will so thoroughly oxidize or act upon organic matters as to prevent them from again entering, at least for a short period, into decomposition, but if the organic substances so acted upon are exposed to the atmosphere, they will again experience decay and putrefaction.

Antiseptics.—Antiseptics, such as corrosive sublimate, arsenious acid, essential oils, carbolic acid, &c., act as such by destroying all source of decay and decomposition, that is to say, they will destroy or prevent the formation of the germs of putrefaction and fermentation, without acting upon the mineral or vegetable matters present. The advantage of their use is, therefore, that they act, when used in small quantities, upon all organic matters in a state of decay; further they are deodorizers, for they prevent the formation of offensive odours, and consequently they may be considered as antiseptics, disinfectants, and deodorizers. The great advantages which carbolic acid possesses over all other antiseptics are, that it cannot be used for any illegal purpose, as arsenic and corrosive sublimate; and further, that its antiseptic properties are so powerful, that a few thousandths of it will effectually prevent the putrefaction of substances such as glue, blood, urine, fœces, and the fermentation of all vegetable matters, such as flour, starch, sugar, &c., &c.

Owing to the inducements which have been held out by some traders, large quantities of a fictitious mixture have been sold to the public as carbolic acid. To enable purchasers to protect themselves from fraud, the following test is supplied on the authority of Mr. W. Crookes, F.R.S.:—"Commercial carbolic acid is soluble in from 25 to 70 parts of water, or in twice its bulk of a solution of caustic soda, while oil of tar is nearly insoluble. To apply these tests:—1. Put a teaspoonful of the carbolic acid in a bottle; pour on it half a pint of warm water; shake the bottle at intervals for half an hour, when the amount of oily residue will show the impurity. 2. Dissolve one part of caustic soda in ten parts of warm water, and shake it up with five parts of the carbolic ccid. As before, the residue will indicate the amount of impurity. These tests are not given as having any pretension to scientific accuracy, but as affording persons who are desirous of using carbolic acid a rough and ready means of seeing whether or not they possess the right article."

† Translated from the "Berg-und hüttenmännische Zeitung," August and September, 1867.

wide, was chosen as a suitable place for the experiments. The shaft was being sunk in the "country" (*i.e.*, not on the vein), which consisted of hard grey gneiss, now and then only it had a few joints, which rendered the work easier. This happened to be the case on the day of the above-mentioned experiments, and partly explains the extraordinary effect produced by the nitroglycerine. The effect was indeed extraordinary, because boreholes, placed so as to give them twice as much to do as usual, and even more, did their work perfectly, and, indeed, more than sufficiently, for they caused such an accumulation of stuff in the shaft that for three days no more boring could be done, and the men had to devote themselves entirely to winding up the stuff. The holes were bored partly single-handed, and then one inch in diameter and 27 to 30 inches deep, partly by two men, and then two inches in diameter and 36 to 48 inches deep. The holes were charged in the mode originally adopted by the agent. As all the holes looked downwards, the nitroglycerine could be poured in by means of a tin funnel. Upon the top of it a small wooden cartridge, three inches long, containing a little powder, was let down by means of the Bickford's fuse, to which it was attached, and then the hole was filled up by hand, without using any tool at all, first with mud and then with sand or small stuff.

It appeared from these first experiments with nitroglycerine that, without any exaggeration, its power was four or five times greater than that of the powder hitherto in use. From this it naturally followed, as the advantages of a powerful explosive material would be most felt in large workings in close little-jointed rocks, such as sinking a shaft in the "country," that such workings could be carried on much faster than had previously been the case. This advantage which nitroglycerine afforded could only be looked upon as most important.

Besides, other advantages were apparent, which, it is true, did not seem so great as the first, but which, nevertheless, promised to exercise a decidedly favourable influence on the economy of mining. They may be summed up as follows:—

1. Fewer men are wanted for working out a certain sized piece of ground, and fewer holes have to be bored than at present. A dearth of miners may to a certain extent be remedied in this manner, and less steel and iron will be used than hitherto.
2. Nitroglycerine does not take fire easily, and when lighted burns but does not explode, and goes out as soon as the flame with which it had been brought in contact is taken away.
3. The holes can be tamped easily, quickly, and without danger.
4. The amount of smoke after a blast is small compared with that of powder, and workmen can go back at once to the place where they have blasted without trouble. This is a considerable advantage in places where there is but little draught, and holes can be bored and fired singly, which was hitherto almost impossible in consequence of the all but impenetrable smoke, and had to be avoided as much as possible.
5. Holes that have missed or only partly torn can be retamped and shot off, which, with the present arrangements is either impossible or accompanied by great danger.

Against these advantages must be set the following disadvantages:—

a. The gases formed during the explosion of the nitroglycerine have an injurious effect on the organs of sight and respiration.

b. Nitroglycerine explodes on being struck smartly, and easily freezes.

c. The masses of rock which it removes are mostly very large, and considerable time has to be spent in breaking them up.

With regard to the first of these disadvantages, it should be remarked that during the first day's experiments, scarcely any signs of pain in the eyes or head were remarked, although the bottom of the shaft was not particularly well ventilated; later they grew more and more marked, so that it became gradually more apparent that where nitroglycerine was used every effort should be made to secure good ventilation. In the course of time, however, the workmen seem to have become accustomed to the smell, and this disadvantage of the nitroglycerine was no longer looked upon as one which need restrict its employment.

The dangerous property of nitroglycerine of exploding from a smart blow, cannot be denied, but this is not more dangerous than the property of ordinary gunpowder of taking fire readily and exploding; and again, the fact of its freezing must be looked upon rather as an inconvenience than a danger.

We must allow that the last of the three disadvantages also exists; holes blasted with nitroglycerine throw down large masses rather than small. These may esaily be broken up with a sledge, or, if necessary, be blasted. At all events, it is no greater disadvantage than what happens so often with powder; the rock is blown into small pieces, which are sometimes thrown to a great distance, and may perhaps do damage, not only to the workings but also to the miners. On the contrary, it would seem to be rather an advantage than a disadvantage that the rock should be thrown down gently and without danger, because the workmen, the timbering, and masonry are not so liable to be injured as in blasting with powder.

All the results of the first trials with nitroglycerine were so favourable, that they naturally instigated us to obtain further and more certain proofs of the possibility of practically employing nitroglycerine underground. A comparative experiment was made between the nitrate of soda powder in use here and nitroglycerine at Segen Gottes mine, in sinking a shaft, in driving a level, and in stopes. The nitroglycerine was tried first; 226 holes were bored, in all 5,043 inches (English) deep. Of these holes, 180, or 80 per cent., tore perfectly, 40, or 17 per cent., only half, whilst 6, or 3 per cent., did nothing. 9·302 cubic fathoms (English) of ground were removed; the smith's cost was £1 6s.; blasting materials cost 17s. 1¼d.; nitroglycerine, £11 11s. 6d.; wages, £23 12s. 9d.; so that the cubic fathom cost £4 0s. 4d.; the end, on account of its small dimensions, costing comparatively the most, and the sinking of the shaft, for the opposite reason, being the cheapest work. The experiment with the nitrate of soda powder was then made; 559 holes were bored, in all 9,249 inches deep, or 333 holes, with a depth of 4,206 inches more than in the previous experiment. 315, or 57 per cent., tore perfectly; 225, or 40 per cent., only half; and 19, or 3 per cent., not at all. By means of these holes, 6·036 cubic fathoms of ground were removed, in which the end and the stopes do not stand anything nearly so far behind as in the first case. The smith's cost was £1 18s. 2d.; blasting materials, 9s. 7d.; powder, £3 13s.; wages, £24 7s. 10½d.; so that the cubic fathom cost £5 0s. 9¾d. With powder, therefore, 3·266 cubic fathoms less ground were removed, though the wages (in spite of one case of loss of wages) were 15s. 1½d., and the smith's cost 12s. 2d. more; on the other hand, on account of using the needle in blasting, the blasting materials cost 7s. 6¼d. less; the powder also cost £7 18s. 6d. less than the nitroglycerine. Taking all together, the cubic fathom with powder cost £1 0s. 5¾d. more than it did with nitroglycerine.

These experiments show that the employment of nitroglycerine, especially in large workings, already offers great advantages over ordinary powder, and that these advantages lie in the fact that with fewer holes, and in a shorter time, a greater amount of ground can be removed than by the present mode of proceeding. Besides, in working out any given quantity of ground nitroglycerine is found to do the work much cheaper, on account of the extraordinary force with which it blasts the holes, and the smaller quantity of iron and steel used up. Lastly, the holes can be tamped much quicker and without danger, as if they are loosely filled with sand, any small stuff, or even water, they can be considered as thoroughly well tamped. But even a stronger tamping, such as is in use in the Hartz, has, up to the present time, been entirely exempt from danger, and has doubtless caused a greater effect, under certain circumstances, as may be readily understood. In the Hartz, the cartridges, made of well-glued paper, are filled with sand in order to make them stiffer, and especially to allow their being longer, and thus to spread the explosive force over a greater area; in other words, to give the explosive force a greater leverage, and thus increase the effect. The proper quantity of nitroglycerine for each hole is then poured into the cartridge by means of a little can with a spout, until the sand is more than saturated, and the whole of the nitroglycerine forms one single mass; on the top a little sand is put so as to close the cartridges better, and then the upper part is pinched up just as in the cartridges filled with powder. Where nitroglycerine is used alone, without sand, the cartridges are made long and narrow for the reason explained above; they are closed with a cork. The cartridge in either case is carefully let down into the hole, or pushed in with the tamping bar, or scraper. Upon the top of it comes a paper cartridge, about two or three inches in length, not particularly strong, and filled with good powder, such as sporting powder: it has the ordinary iron needle stuck in it, but without the reed; a little clay is stuck on the top of the cartridge and round about the needle. The tamping employed is clay-slate beaten up fine, and made into a soft mass with water; this is moulded into lumps like pieces of peat, and when dried is ready for use. This tamping is forced in with the iron-tamping bar, the wooden one being discarded; the first blows are gentle, and then gradually harder and harder until the mass rings. The hammer, however, is not used, the tamping is simply rammed in with the iron bar. When the hole is tamped it is clayed over, the needle drawn out, and instead of the reed filled with powder, a paper fuse is stuck in and the hole fired off.

The results obtained by the experiments described above would probably have been greater had the workmen been as thoroughly accustomed to the use of nitroglycerine as they are to that of powder. This may be inferred from the fact that far fewer holes were bored in the experiments where nitroglycerine was used than in those where powder was the blasting material employed. For though it must be conceded that holes blasted with nitroglycerine brought about more delay, and caused more time to be spent in winding stuff, and thus caused a loss of time, still the difference in the number of holes bored is so great that we may assume that the men would have bored more holes if they had had more experience in the mode of procedure adopted with nitroglycerine.

The same thing no doubt happened when gunpowder was first introduced, and probably less work could be done with it, and much more danger accompanied its employment, than has since proved to be the case.

In speaking of the many advantages which, according to these experiments, nitroglycerine possesses over gunpowder, it may be added that still further progress has been made with regard to its introduction, and people have not been stopped even by two accidents which have occurred from using it. In one case walls to keep up the attle heap were being built out of some large pieces of rock brought up from the Beihilf shaft, and which had been lying out in the air for some time. These pieces had to be trimmed a little with the hammer, and during this work a small explosion occurred, slightly injuring the mason in the eye.

The explosion was probably caused by some nitroglycerine which had escaped decomposition and remained sticking to the rock. In the second case a hole in the mine did not tear the rock properly but simply split and loosened it. As the miner was removing these loose pieces an explosion occurred from undecomposed nitroglycerine which remained in the cracks. Luckily, the man was but slightly injured.

The accidents can only have occurred from the nitroglycerine having been used alone without any cartridge, or from the hole not having been properly clayed, so that the nitroglycerine found means of getting into joints and cracks and escaped decomposition. The consequence has been that nitroglycerine is not so often poured straight into the hole, but is enclosed in a cartridge of paper well joined with glue, and in order to give the cartridge greater strength, and the explosive material a greater area to act on, the cartridge is first of all filled up to a certain height with sand, or, as I have since tried, it is at once filled with common powder.

Now, although it has been remarked that a hole containing free nitroglycerine does more work than one in which the blasting oil is contained in a cartridge, which somewhat hinders the quickness of its decomposition, it must not be assumed that the real reason has yet been hit upon, and before a final decision further evidence must first of all be obtained.

Further experiments were made in the above-described manner in sinking a shaft in clay slate. During a period of three months the men were paid for having worked 372 shifts, £13 15s. 9½d., or, adding in the money paid for extra work, £2 10s. 0¾d., altogether £16 5s. 10¼d. 251 holes, with a total depth of 7,520 inches, were bored, and 11·972 cubic fathoms of ground were removed. Of these holes 229, or 91·2 per cent., tore perfectly; 18, or 7·2 per cent., only half; and 4, or 1·6 per cent., simply blew out, but could be used again on being recharged. In each shift, then, ·67 of a hole, or 20·2 inches were bored, and ·0321 of a cubic fathom of ground removed, which cost 9d., or, including the extra wages, 10½d. The smith's cost was 9s. 4d.; blasting materials, 16s. 5d., and the expense of 99·67 pounds of nitroglycerine £17 18s. 9¾d; so that the total expenditure was £35 10s. 5d., or £2 19s. 3½d. per cubic fathom.

The results of these experiments are still more favourable than those obtained previously, and the reason of this lies in the fact that the experiments were confined to a shaft which was being sunk of greater length and breadth than the previous one, and, consequently, the full effect of the nitroglycerine was obtained. The sinking of the shaft in question has been consequently continued with the aid of nitroglycerine, and with excellent results, for the holes do quite three times as much work as they did with gunpowder. The sinking of course proceeds more rapidly; the complaints about headaches caused by the nitroglycerine have ceased, and no other inconveniences have manifested themselves. It must not be denied that this favourable result is partly owing to the length and breadth of the shaft, the tight nature of the ground, as well as to the porous nature of the clay-slate, and the wetness of the sinking. Still some means should be discovered to lessen or prevent entirely the injurious effect which nitroglycerine has on the health of the workman. If further experience does not bring any other disagreeable qualities to light, there is no doubt that nitroglycerine will be more generally introduced in certain workings to which it is specially adapted, and then further improvements may bring about still more important results than those which have already been obtained in certain cases.

A NEW MODE OF CONSTRUCTING THE SURFACE OF STREETS AND THOROUGHFARES.

By JOSEPH MITCHELL, F.R.S.E., F.G.S., C.E.,

Lately General Inspector of Roads and Bridges in the Northern counties of Scotland.*

The wear and tear of an ordinary macadamized road, and, consequently, its cost of maintenance, are very great.

The explanation appears from experiments which show that a cubic yard of macadamised stone, when well pressed down in a box with a capacity of 27 cubic feet, contains 11 cubic feet of vacuities; and that a roadway covered with 12 inches of metal, before it is consolidated into a smooth and useful surface, has a large portion of its stones crushed into small particles, and that more than one-third of its dimensions consists of mud and sand. When heavy rains occur, combined with heavy traffic, disintegration of the stones in such a roadway takes place, and quantities of mud are generated in proportion to the amount of traffic.

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* Read before the British Association at Dundee.

In the new mode of constructing a roadway which I propose, the vacuities in the metal are filled with cement grout, which, when hardened, forms a concrete, binding together the macadamised stones into a mass impervious to water, and, unlike asphalte, unaffected by heat: while, at the same time, it preserves entire the original size and dimensions of the stone.

Again, everyone must have noticed the tear and wear of the causeway stones in an ordinary street pavement, and the irregularities of the surface of the streets, after six or twelve months' traffic. Granite and other stones of the hardest quality appear to give way under the weight of the traffic. The explanation of this waste may be found in the ordinary mode of constructing street pavement. The stones are laid on a bed of loose sand some two or three inches deep above the soil, and are then beaten down into an approximately even, but really irregular, surface. They are laid $\frac{3}{4}$ths of an inch to $1\frac{1}{2}$ inch apart, and the intervals between them are filled up with sand (which is soon reduced to mud). Thus, each stone is insulated, and made to rest on a yielding surface.

In a street so constructed, the ends of the causeway stones are found, after 12 months' traffic, to be worn down from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch. This arises from the percussion of the wheels of carts and carriages falling from the centre of one stone on to the joint of the two adjoining, which, being on a yielding surface, and the wheels striking on the ends, sink a little from the pressure. When a stone has sunk bodily from $\frac{1}{2}$ inch to an inch, or when a little hollow occurs in the pavement of the street, it will commonly be found that the adjoining stones are much worn, the hollow on the surface increasing the force and effect of the percussion of the wheels. The greater the hollow the greater is the tear and wear from the strokes of the wheels.

The source of waste is seen to be the yielding surface on which the stones are laid. To prevent their tear and wear, what was wanted seemed to be a rigid and perfectly regular surface, by which also the traction might be greatly improved.

These defects in the construction of causeway have long been noticed, and the only remedy hitherto used, and which has been in very general use (but which has always failed), has been, to lay a body of lime concrete, six inches deep, below the stones, and to fill with lime grout the joints or intervals between them. The lime, it has been found, has never consolidated, owing to the stones being beaten down when it is half set, and to the tremor subsequently caused by the traffic. Thus, on the best paved streets, after heavy rain or watering, much mud is generated from the wet unconsolidated lime and sand. Where there is much traffic, as in London, this mud on the surface, in drying, proves slippery and dangerous, and many serious accidents occur in consequence.

The irregularities of the surface, and consequent mud, are increased by two inches of sand being placed between the bed of lime concrete and the bottom of the paving stones.

In the new mode of constructing street pavement which I have proposed, there is first laid down a bed of cement concrete three inches deep (gravel may be used instead of macadamized stone where abundant and cheaper), and to the requisite convexity in the cross section. This concrete quickly consolidates, and entirely excludes moisture or water from below.

On this foundation, the paving stones, five inches deep and three inches wide (a width of three inches gives a better hold to the horses' feet than a width of four or four and a-half inches, which are the common sizes), are built, and when brought to a perfect form, the joints are filled with cement grout. When the whole is consolidated, it forms a surface perfectly immoveable by traffic, and impervious to moisture. The wear and tear of the stones arise from the attrition of the traffic only. If the causeway be well made, there should be no irregularities on the surface. Where such irregularities exist, they are due to defective workmanship.

Three experiments have been made to test the merits of the new or concrete road, and two to test the merits of the new form of causeway.

The first trial road and pavement were laid down in Inverness, early in 1865. They have been under traffic for upwards of two years, being passed over by the whole goods traffic of the Highland Railway. The road is now perfectly sound, and it has required no repairs; whereas the macadamized roadway adjoining it has constantly required repairs, and is now full of irregularities and ruts.

The second trial new road was laid in London. As it was important that this plan of roadmaking should be subjected to the test of severe traffic on some of the London thoroughfares, I applied to, and obtained permission from, the Right Honourable William Cowper, Chief Commissioner of Works, to lay down 100 yards of it in length, by 35 in width, on the Mall in St. James's-park, at the foot of the Green-park. The whole traffic between the district of Regent-street, Piccadilly, Pall-mall, Buckingham-gate, and the Victoria Station, passes along this route, which is, apparently, subjected to as heavy traffic as any thoroughfare in London.

Subsequently, this road proved a failure, the surface breaking up under the traffic. My explanation of the failure (which was very puzzling at first) is as follows:—The roadway at each end of the experiment was macadamized at the time the experiment was made, and the contractor's men, who were crushing the macadamized road with a heavy roller of three to four tons weight, were inadvertently permitted by the person in charge to pass their heavy roller from end to end continuously over the experiment before it had properly consolidated. The crystalline structure of the cement was injured by this, and in consequence the surface yielded to the incessant cab traffic, and the month of continuous rain to which it was immediately thereafter exposed. The surface was repaired by the trustees, by a coating of two inches of macadamized stone, which was rapidly ground down on the hard concrete by passing vehicles. As the bottom was entire and consolidated, had a coating of two or three inches of new concrete been laid down, with the required time to consolidate, it would have answered all the purposes contemplated; but the surveyor deemed it his duty to remove the concrete surface entirely, which was only done at great trouble, by means of levers and iron crowbars. The experiment was certainly a failure; but, in attempts of realizing new conceptions, it is in the nature of things that there must be repeated failures before success is reached.

The third experiment was made in Edinburgh, and has, in my opinion, proved very satisfactory and successful. A length of 150 feet of concrete road by 45 feet in breadth, and a similar extent of street pavement, were laid down last summer at George IV. bridge, where the traffic is heavy and continuous. One half of the street was laid down with the concrete at a time, and the traffic was rigidly kept off that portion for a month. The other half was then laid down. The whole roadway has since been under traffic for 12 months, and has proved perfectly sound and immoveable, not a stone turning up all that time. After the road had consolidated, and had been under traffic during the winter, it was observed that some small hollows had shown themselves at the joinings along the centre of the roadway; this arose from our inexperience in laying down the concrete, and will in future be avoided. These hollows were cut out, and made up with new concrete, and opened for traffic in a week. The result has been that the surface is now perfectly smooth and regular.

The street pavement on the south end of the concrete road was then laid down on a bed of cement concrete three inches deep.

The cement concrete was permitted to consolidate for about ten days, and thereafter the pavement was built on it with cement mortar; and when the stones were regularly set, the joints were filled up with cement grout.

The pavement has also been perfectly successful, the water running off it as from a foot-pavement, leaving no mud; and the only wearing of the surface is from the attrition of the traffic.

It has been stated that the noise of vehicles on the pavement is greater than on the ordinary pavement. I do not consider it greater: The blows arising from the irregularities on the ordinary pavement are noisy, as well as destructive to the road and to carriages; but the noise on the concrete pavement, though not greater, is different, it having more of a ringing sound, like that on a street bound up with frost.

In point of wear and tear, and freedom from mud and dust, this street pavement has many undoubted advantages over that now in common use, particularly where there is heavy traffic; but I anticipate that a road consisting of a good body of concrete would supersede even this species of street pavement.

The following is an extract from a report made by me to Mr. William Duncan, Secretary to the Edinburgh Road Trustees.

"The concrete road cost 6s. 8d., and the paved road 17s., per square yard. A sum of 1s. 8d. per square yard was incurred for excavating and removing the materials of the old road, and for watching; but I calculate that the value of the old materials would go to meet these outlays. The small experiment that has been made, however, is not a good criterion of the cost. In a work on a large scale, the cost ought to be less.

"The advantages offered by this mode of construction on a road under heavy traffic, as far as our experience has gone, are—

"First, diminished tear and wear. The general surface is apparently not worn in twelve months more than one eighth of an inch.

"Second, superior cleanliness. The road is almost wholly free from mud and dust.

"Third, diminished cost and annoyance from repairs. The road has required little or no repairs for twelve months. It requires no scraping or watering; and its maintenance is almost nominal, while the coatings, scrapings, and waterings of a macadamised road under similar traffic in Edinburgh, cannot be done under 1s. to 1s. 6d. per square yard per annum, besides the great inconvenience and discomfort they cause to the public.

"The original cost of a macadamised road nine inches deep, which, before it is consolidated, is crushed into six inches of available material, is about 2s. per square yard, or say somewhat less than one third of the concrete road. In London, where the metal is 20s. the cubic yard, instead of 6s., as in Edinburgh, and where the cement is cheaper, the cost of a road of nine inches of metal will nearly amount to the cost of a concrete road.

"It thus appears that the cost of the concrete road will be proportionally less, and its advantages proportionally greater, in London and towns similarly situated, than in Edinburgh.

"The cost of the concrete pavement, which is 17s. per square yard, is higher than it should be, as the stone was procured from Aberdeen instead of the neighbourhood of Edinburgh, and gravel would have served for the concrete bottom quite as well as the more expensive macadamized stone.

"In conclusion, I consider that the experiment which, through the liberality and public spirit of the road trustees, I have been permitted to make on this most important subject, has been successful—the road having sustained the traffic on George IV. Bridge without a stone being moved for 12 months; and that it only requires further experience in the manipulation and laying down of the concrete to accomplish all that I anticipated from this new mode of road-making."

Since the date of this report, Messrs. Wylie and Slight, engineers in Edinburgh, have been good enough to make experiments which show that the new road possesses another advantage over the old. It was natural to anticipate, that, from the superior evenness and solidity of the new road, the traction would be less upon it than on common roads; and these gentlemen have found that the traction on the concrete road of a waggon two tons weight, against a gradient of 1 in 80, was 70lbs., while, on a common macadamized road of the same grade, wet and muddy, it was 140lbs., or double that on the concrete road. On a road with wheel-tracks through new metal, it was 340lbs.; and on a road newly covered with metal, 560lbs. The gradients of these several roads were 1 in 80.

The experiments are to be further prosecuted, as the dynamometer got injured; and I have every confidence that they will establish the very great superiority of the new road as regards traction—a circumstance affecting the preservation of horses and carriages, and the comfort of travelling. Many experiments will yet have to be made before the merits of the new road and pavement can be held to have been conclusively tested. In particular, it will be necessary to have an experiment on a large scale before the cost of construction and maintenance of the new road can fairly be put in comparison with the cost of construction and maintenance of the roads now in use. But, in the meantime, so far as my experience has gone, I feel entitled to sum up the advantages of the new roadway over the old, in the four following propositions, viz.:—

1st. The tear and wear are less on the new road than on the old.

2nd. The cost and annoyance of repairs are less.

3rd. The mud and dust are a minimum quantity, and there is superior cleanliness.

4th. The traction is less, as has already been proved.

It must be observed, however, that the entire efficiency of this mode of road-making depends on the quality of the cement, which should be the best Portland cement, tested to bear a tensile strain of 500 to 600 lbs. on a bar 1½ inch square. Time, after the road is made, is a great element of efficiency, as the hardness of the concrete gradually doubles in the course of 12 months; but further experiments are necessary to determine the precise time the road should be left for consolidation before it is opened for traffic—a month I found quite sufficient in Edinburgh.

FRIENDLY SOCIETIES IN ENGLAND AND WALES.

The annual report of the registrar of Friendly Societies has just been issued. Setting out in due order with those societies which are generally denominated "Friendly Societies," Mr. Tidd Pratt reports that he has had submitted to him for certification the rules of 1,176 new societies and alterations of rules of 1,487 existing ones, making a total of 2,663 certificates. Forty-three societies, not certificated, have deposited their rules with the Registrar, and, under the provisions of 18 and 19 Vic., c. 63, sec. 44, have obtained protection for their funds against fraudulent officers. Notices of dissolution of 130 Friendly societies have been received, and 83 of them advertised in the *London Gazette*. Concerning the dissolution of these societies, Lord Lichfield, in the latter part of the last session of Parliament, moved for returns exhibiting the number of societies which had been registered under the Friendly Societies' Acts since the passing of the first of these Acts in June, 1793, and of the number dissolved, and also a supplementary return from the Poor-law Board, showing the number of persons who have become chargeable to the parish, and are paupers in the workhouse, who have been members of friendly societies which have been dissolved or broken up. These returns show that in England and Wales 38,315 societies have taken the benefit of the provisions of the Friendly Societies Acts since June, 1793, and that of these 13,935 have been dissolved, and that those remaining number 24,380. The number of paupers who have been members of dissolved friendly societies is stated at 3,931 in England, and 84 in Wales, a total of 4,015 coming under the immediate notice of the Registrar.

Three or four years ago the public was startled with the revelations Mr. Tidd Pratt made in his annual report, of the proceedings of certain societies (chiefly societies held at public-houses) which periodically made returns to him, and had the effrontery year after year to publish in their accounts the record of expenses illegally incurred in feasting and drinking. A great portion of that illegality has now disappeared, but in its place the Registrar has now to call attention—as he has, in fact, before done—to the excessive expenditure of some so-called friendly societies under the head of "management."

The Royal Liver Friendly Society, established at Liverpool in 1850, returns its gross receipts at £125,181, its management expenses at the enormous sum of £45,857. As the Registrar points out, out of every £100 received £36 12s. 9d. is spent in management. Its sickness and burial expenses amounted to £60,880; and in proportion to every £1 spent under this head, 15s. 1d. was spent in expenses. The accumulated funds amount to £103,355, but, as in former years, the officials declined to furnish the Registrar with the number of its members, and he is thus unable to make any comparison as to the value per member. Another society, the St. Patrick's (also established at Liverpool), expends £49 15s. out of every £100 it receives in management expenses, and that its resources are very large may be estimated by the fact that £33,270 is returned as its gross income for the past year, and its accumulation as only £17,797, the property of 150,000 members—about 2s. 4d. per head. The Victoria Legal Friendly Society returns its income at £28,431, and its expenditure at £24,140, and its funds at £10,544.

"The Royal Liver," and similar societies, the Registrar points out, should at once become the subject of exceptional legislation, as they depart almost entirely from the original idea of a friendly society. "It is notorious" (says the registrar) that great hardships are suffered by the persons who join them; that the members are generally poor, that they are spead all over the kingdom, frequently hundreds of miles from the office of the society; they never participate in its management, and the whole business is managed by a few collectors and a central and irresponsible board, over which the secretary reigns supreme, and not the slightest check can be obtained over him. In these societies, in case of death it frequently occurs that a dispute is originated as to whether the member was or was not within benefit (as it is termed) at the time of death, but as in this dispute, on the one side is the society and the secretary—with its large funds and irresponsible manager, on the other, people of the class who generally live "from hand to mouth," it is quite clear that the weaker party has to give way, and any idea of obtaining legal redress is quite out of the question at present." The Registrar reports that he had found it necessary to call upon the officers of the Farriers' Society, London, to reimburse certain sums of money—£63 10s. 3d.—which they had illegally expended in the reform demonstration, and that his threat of legal proceedings had been effective in causing the officers to repay the money to the funds of the society.

It appears that out of 23,407 societies only 10,678 returns had been made, and that these returns showed the number of members to be 1,672,176, having accumulated investments to the amount of £6,668,386, of which £1,776,215 was deposited in savings' banks; and that 518 societies had invested directly with the Commissioners for the reduction of the national debt the sum of £1,799,648.

The Registrar reports that savings' banks, co-operative societies, and loan societies being so much connected with the industrial classes, he has thought it right to include in his report statistics relating to these institutions. The number of individual depositors with the old savings' banks in 1866, were 1,376,870; and the amount of their investments was £33,840,096. The number of persons depositing in the post-office savings' banks was, on the 31st December last, 746,254; and the deposits then due to them amounted to the large sum of £8,121,175. The Registrar reports the continued success of these new banks—as may be judged from the following facts:—that in 1866, 186 new postal banks were opened, swelling the total number to 3,507. There were 1,525,871 deposits received, amounting to £4,400,657. The average amount of each deposit was £2 17s. 8d. The withdrawals were 515,348 in number, and £2,975,055 in amount. The average cost of management was 6d. 9-10th for each transaction, 1-10th of a penny less than the cost estimated before the commencement of business. The average cost in the old banks ranged from 10d. to 1s. At the end of 1866, there was standing to the credit of the postal banks (chiefly investments with the National Debt Commissioners) £8,256,968, and the liability to depositors was £8,125,175, showing an excess of assets over liabilities of £135,793, and exclusive of the dividends receivable five days after the account closed. This result is most satisfactory, and shows in the most striking light the great advantage of these banks as providing a means of secure investments for the savings of the labouring classes; and how ready that class is to avail itself of the inducements held out to it. In connection with this system, the plan of Government insurance and annuities appears to be fast gaining ground. From the 17th April, 1865, to the 31st December, 1866, 1,168 contracts for insurance had been made, and the amount assured to policy holders for 1,150 which still remain in existence, is £86,593. The sum received by way of premiums thereon amounts to £4,004 12s. 1d., collected in 4,858 payments. The cost of collection is estimated at £636; and only one insurance had become a claim, and the amount paid thereon was £70 7s. 6d. In the annuity branch during the same period 280 contracts for immediate annuities, assuring £6,427 13s. 6d. per annum, had been granted; and the purchase-money paid to Government for the contracts amounted to £71,568. Forty-four contracts for deferred allowances—under the tables "Money not returnable," and 73 under those headed "Money returnable," had been entered into. The annuities to be purchased amounted to £2,338 15s., but 10 of the contracts had been dropped from various causes, and the amounts had been thereby reduced to £2,129 5s. The total amount contributed by purchase of annuities, immediate and deferred, was £75,756.

Under the head of "co-operative societies," the Registrar reports that the returns for the past year made by 436 of these societies show the number of members to be 173,243, an increase of 22,661 during the year; that their invested share capital is £1,048,096, of which £619,688 has been contributed during the year. The result of the cash transactions is shown as follows:—Goods bought, £3,986,754; goods sold, £4,455,569; profits realised, £376,294; and management expenses, £235,454. The value of the assets of the societies is estimated at £1,009,849, and their liabilities are estimated at £334,561.

Commerce.

Tea in Ceylon.—*The Produce Markets Review* says:—"Mr. Arthur Morice, who has been visiting the tea districts of India, with a view of ascertaining the capabilities of Ceylon as a tea-growing country, has published his report on the subject. As regards soil, Ceylon appears to possess none precisely similar to that described as suitable for the cultivation of tea, but Mr. Morice arrives at the conclusion that there is nothing in the soil to prevent successful cultivation. With respect to climate, the *Colombo Observer* says a great diversity of opinion prevails, and according to what writers have hitherto said it might be supposed that Ceylon is too near the equator to prove a successful tea-growing country. Mr. Morice, however, successfully combats this idea, and although he acknowledges that Ceylon does not in any part possess a climate similar to that of China, Assam, or the Himalayas, yet a comparison with Java (in the corresponding degree of south latitude) and the result of cultivation there, show indisputably that a tropical climate, where the proper elevation can be obtained, is not inimical to the tea plant. Mr. Morice remarks, 'I have come to the conclusion that, at the higher elevations of this island, both soil and climate are sufficiently near those of known tea countries to induce the belief that tea can be grown so as to produce regular crops, and sufficient in quantity to prove remunerative; and that, in all probability, the quality, with proper manipulation, will be such as to enable it to compete with other Indian teas. Tea, in short, is worthy of a fair trial; but, to do the trial justice, the hybrid Assam tea plant should be employed solely. This plant combines the hardiness of the China with the superior producing powers of the Assam parent; besides, the hybrid comes into full bearing at least two years before the China plant, under similar conditions.' The subject of tea cultivation in Ceylon is now receiving much attention, and if the soil and climate of the island are, as is stated, so well adapted to the growth of the plant, there is a possibility that in a few years' time we shall have another country's produce competing in the tea market."

Exhibition of Wines at Alessandria (Italy).—An exhibition and wine-fair is about to be held at Alessandria (Italy); it will be opened from the 24th of November to the 2nd of December. This exhibition and fair comprises three classes; that is to say:—Wines exhibited for competition for prizes; wines for sale; and machines and other implements used for the cultivation of vines and for wine making. In the first class will be admitted only wines made by the exhibitor entirely is to say, in the districts of Alessandria, Acqui, Asti, Novi, and Tortonia. These wines will be from grapes grown exclusively in the province—that divided into three categories, namely, common table wines, choice table wines, and fine wines. The prizes assigned to these classes and categories consist of three gold and three silver medals, given by the Minister of Agriculture and Commerce; and twelve silver and twenty-four bronze medals, given by the Agricultural Committee of Alessandria (Comizio Agrario d'Alessandria). Besides these, three silver and three bronze medals will be distributed to the best wines of each district competing amongst themselves; and such a number of honourable mentions, as the commissioners may see fit to distribute. In the second class will be admitted any kind of Italian wine; these wines will be sold by public auction, private contract, or at fixed prices. The third class will consist of machines, instruments, utensils, tools, &c., employed in the cultivation of the vine and in wine making. Exhibitors and inventors of every country are invited to compete in this class, the prizes of which will consist of three silver and six bronze medals, and such a number of honourable mentions, as the commissioners may see fit to distribute. The "Prize of Honour" consists of a silver medal, and purse of eighty francs, given by the Marquis Balbi-Piovera for the best essay or memoir on wine-growing and making, considered with a view to fitting the wines grown in the province of Alessandria for exportation. Anyone desiring to take part in this exhibition and fair is requested to apply, during October, to the Agricultural Committee of Alessandria. The objects intended for exhibition will be received from the 1st to the 15th of November.

Colonies.

Agriculture in Victoria.—The old system of colonial farming, the growth of wheat, hay, oats, and potatoes, is fast giving way, and every year there is more stock kept on the cultivated lands. The great difficulty with most farmers has been the want of sheep-proof fences, as such things were not thought of in the early days, and when profits were diminishing the outlay could not well be incurred. Now, however, no others are put up, so that before long every holder of two or three hundred acres, or even less, will have his flock of sheep; and with the keeping of sheep the cultivation of English grasses extends, although there is still room for much advance in this direction. On only a few properties in the west district is the laying down of land to continue under grass for a period of years beginning to be part of a regular system, but it must become so generally, for in this way is the fertility of the land to be most easily preserved where high farming cannot be adopted.

Queensland Gold.—The gold fields in the north of the colony of Queensland are causing no little excitement, as rumours of enormous nuggets are constantly being wafted about. There can be no doubt that that portion of Queensland is rich in mineral wealth, and its resources could have been much more fully developed if really experienced miners had paid it a visit some time ago. Many professional diggers have been deterred from going to this part by some doubt about the presence of gold in paying quantities. The consequence is, that by far the majority of the men on these northern fields are inexperienced, and it will take some time before the full value of the ground is established.

The Pastoral Prospects of Queensland may be reported as particularly good. Throughout the winter, grass and water have been abundant, and an early and successful lambing season is looked forward to as a means of helping the pastoral settlers through many of their difficulties. A noticeable feature is the excessive numbers of fat cattle and sheep, for which it is difficult to find a market, as the neighbouring colonies, at the present time, are almost self-supporting in that respect. A good many sheep are finding their way across the borders. Boiling down is, however, much resorted to by stockholders. At Maryborough and on the Brisbane, something is being done in the way of preparing meat for exportation; but the general impression is that in future a fourth of the stock of the colony will have to be disposed of for the tallow.

Notes.

The Excavations at Pompeii.—An interesting report has been published by the Senator Fiorelli, superintendent of the Museum of Naples, and of the excavations at Pompeii, on the important archeological discoveries that have been made in Italy from 1846 to 1866. During this period, no fewer than 25,864 different objects have been found at Pompeii, amongst which the most numerous are 9,831 ancient coins, chiefly of bronze. Various articles of female jewellery in gold and precious stones have likewise been found; necklaces in gold and silver, surgical instruments, sun dials, arms, cymbals, mirrors, lamps of metal, and tools of various trades. Amongst the natural products that have been found in a good state of preservation may be mentioned vegetables of every variety, olives, nuts, dried figs, grapes, apples, and peach stones. Some of the grains of corn that had been buried for ages were sown, and have produced fresh ears of corn, which has been even ground, and the flour made into bread. In this necropolis 27 human skeletons have been disinterred; plaster casts have been taken from some of them. The remains of two horses, eleven fowls, eight dogs and several turtles have likewise been dug out.

Progress of the Mont Cenis Tunnel.—The Italian government have published the usual monthly statement of the progress made in the Mont Cenis Tunnel. According to this the length of the boring up to the 1st September was 7,403·52 mètres, to the 1st October, 7532·25 mètres; showing a progress of 128·73 mètres during the month of September, and as the total length of the tunnel is 12,220 mètres, only 4,687·75 mètres, or about one-third, remains to be finished.

Beethoven's Piano.—An interesting souvenir of the celebrated composer, Beethoven, is at present in the possession of an inhabitant of the town of Klausenberg, in Transylvania. This instrument, which must have been made more than seventy years ago, is in a good condition; and on one of the panels is painted a portrait of the great musician when twenty years of age. This piano is said to be the one that was presented to him by the maker, Voggel, of Pesth.

Patents.

From Commissioners of Patents' Journal, October 18th.

Grants of Provisional Protection.

Animal matters, utilising refuse—2822—J. H. Brown.
Anvils—2578—W. E. Newton.
Batteries, floating, propelling and manœuvring—2743—J. Elder.
Bedsteads and mattresses—2766—T. E. Clarke.
Billiard and dining table combined—2762—G. F. Green.
Blacking, metal-founders'—2505—F. H. and J. W. H. Pattison.
Boilers—2777—C. Mace.
Boilers, &c.—2780—W. Spence.
Boots and shoes—2735—C. Mole.
Boots and shoes—2779—W. R. Lake.
Boots and shoes—2805—W. Low and J. Treadwell.
Braid, machinery for manufacturing—2799—J. H. Johnson.
Buildings, arches, &c., construction of—2729—S. Parr and A. Strong.
Camphor, refining—2816—C. D. Abel.
Candles, &c.—2734—F. Meyer and W. Wainwright, jun.
Candles, &c.—2761—J. L. Field.
Cartridges—2550—G. Clark.
Castors—2765—R. Fletcher.
Chemical products, &c., manufacturing—2760—G. Allibon and A. Manbré.
Chimneys, &c.—2677—W. Cooke.
Chlorine, &c., obtaining—2801—J. Anderson.
Cigar and pipe lights—2459—H. J. Simlick.
Cotton, &c., used in dentistry, treating—2785—A. M. Clark.
Egg-boiling apparatus—2750—I. Dimock.
Fabrics, &c., treating mixed—2803—G. Martin.
Fans—2737—L. Laine.
Fire-arms, breech-loading, extracting cartridge cases from—2725—R. Adams.
Fire-lighters and artificial fuel—2820—H. Trotter.
Fruit, cleaning—2814—H. Faulder.
Fulling machines—2775—G. Ramsden, L. Webster, and J. Walker.
Furnaces—2781—R. Dick.
Furnaces, burning oil in—2752—J. Donald.
Furnaces, &c.—2756—E. P. Alexander.
Furnaces, &c.—2757—T. Bird.
Furnaces, &c.—2772—C. Ritchie.
Furnaces, &c.—2782—H. D. Pochin and E. Hunt.
Gas burners—2811—N. F. Taylor.
Gas lamps and burners—2643—L. Lenzberg.
Grain, drying—2804—J. S. Williamson.
Grain, drying, &c.—2659—J. S. Williamson.
Hat-blocking machine—2728—A. M. Clark.
Hats, &c.—2742—H. Killogg.
India-rubber tubing—2744—M. Hamer.
Iron, sheet—2768—R. H. Taunton.
Knives, &c., sharpening—2603—R. Canham.
Laboratory, portable—2784—W. E. Gedge.
Lamps—2741—E. Lever.
Leather, manufacturing articles of—2559—J. H. Brown.
Locomotive engines, &c.—2755—J. Clark.
Looms—2724—J. E. H. Andrew.
Looms—2727—F. Frew and J. Speirs.
Looms—2754—C. Honegger.
Looms—2790—T. Sagar and T. Richmond.
Looms—2815—C. J. Galloway.
Match boxes—2764—W. E. Gedge.
Mattresses—2363—L. A. Bainée and M. J. Sibillat.
Mats, india-rubber—2783—G. P. Dodge.
Metal, moulding—2813—J. Smith.
Metal, &c., drilling, &c.—2732—F. Branscombe.
Metallic tubes, ornamental—2749—T. Weston.
Mowing and reaping machines—2763—W. Mitchell.
Mules for spinning, &c.—2747—B. Dobson and R. Halliwell.
Nails—2733—J. and J. A. Huggett.
Nails—2769—F. Parkes.
Nails and spikes—2788—G. Mellor.
Needles, machine—2787—G. Townsend.
Omnibuses, &c., registering apparatus for—2821—T. Ollis.
Packing, lubricating—2746—T. Silver.
Paraffin, &c., treating—2731—L. de la Peyrouse.
Pipes and cigar tubes—2817—R. P. Faucheux.
Pneumatic springs—2810—J. Piddington.
Potatoes, preserving—2753—J. Dewar.
Pumps—2809—L. Williams.
Railway carriages, &c., ventilating—2078—A. B. Ibbotson.
Railway carriages, &c.—2796—J. Offord.
Railway fastenings—2771—C. J. Appleby.
Railway points—2795—W. Smith.
Railway trains, transmitting signals in—2730—J. and F. S. Cocker.
Railway wheels—2739—J. H. Johnson.
Rollers for maps, blinds, &c.—2631—P. Porter.
Ropes, winding—2759—J. G. Jones.
Rules, jointed—2807—A. Bradburn and S. T. Marsh.
Sewing machines—2770—A. C. Henderson.
Sewing machines—2794—J. Gutmann.
Ships—2798—G. H. D. Mathias.
Ships' bottoms, cleaning whilst at sea—2748—C. P. Jones.
Signals—2691—P. H. Colomb and F. J. Bolton.
Skins, treating—2736—H. A. Bonneville.
Spinning machines, &c.—2767—W. and S. Smith.
Steel scrap, utilising Bessemer—2789—A. T. Becks.
Swimming apparatus—2793—A. Ford.
Tobacco—2699—A. Tod and J. Heatley.
Type, distributing—2800—R. Hattersley.
Typographic apparatus, form-fixing—2645—F. T. M. A. Guyon.
Urinals—2776—F. J. Jeffery.
Vehicles, registering passengers travelling in public—2740—G. R. Solomon, jun.
Watch chains, &c., securing—2751—W. James and W. Hill.
Wood, &c., articles of, ornamenting, cutting, creasing, and bending—2139—E. Tomlinson.
Zinc, manufacturing—2819—D. Swan, jun.

Inventions with Complete Specifications Filed.

Baths, medical electric—2835—A. Danilecki.
Gas burners—2859—J. Brönner.
Grain, decorticating—2872—H. A. Dufrené.
Smoke consumer—2871—J. B. P. A. Thierry.
Telegraphs—2879—W. R. Lake.

Patents Sealed.

1147. W. Kirrage.
1158. R. H. Frith.
1161. W. G. Crossley.
1163. J. W. Cochran.
1167. J. Needham.
1170. J. B. Mannix.
1171. C. T. and E. Hook.
1180. S. J. Mackie.
1204. H. Smith.
1205. E. G. Fitton and S. Dear.
1318. B. H. Smith.
1384. W. Bracewell, W. Pickup, and B. Lund.
1387. A. Cooper.
2004. J. J. Buckley and C. Hook.

From Commissioners of Patents' Journal, October 22nd.

Patents Sealed.

846. J. and A. Gamgee.
1073. R. Day.
1184. W. F. Wilkinson.
1189. J. D. Brickles.
1192. W. R. Lake.
1198. C. E. Brooman.
1212. E. Guenin.
1214. G. A. Huddart.
1231. C. E. Brooman.
1242. R. Smith and M. B. Westhead.
1254. A. M. Clark.
1261. F. Jossa.
1265. J. H. Johnson.
1266. J. H. Johnson.
1282. C. Dutton.
1292. A. M. Clark.
1329. T. Crow.
1429. A. V. Newton.
1469. A. V. Newton.
1514. A. V. Newton.
1547. A. M. Clark.
1550. T. Greenwood.
1600. T. Greenwood.
2379. W. E. Newton.

Patents on which the Stamp Duty of £50 has been Paid.

2538. R. Wright.
2559. A. Hill.
2570. J. Hart.
2604. F. Martin.
2678. A. and W. Smith.
2612. G. E. Donisthorpe.
2623. W. Richards.
2642. G. E. Donisthorpe.
2675. A. Parkes.
2585. T. Turner, jun.

Patents on which the Stamp Duty of £100 has been Paid.

2552. J. Thompson and E. G. and F. A. Fitton.
2525. W. Henderson and J. Down.
2561. W. Jamieson, W. Robinson, and C. Rowbottom.
2651. W. T. Vose.